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SPACE SCIENCE ADVISORY COMMITTEE

March 5-7, 2002
NASA Headquarters
Washington, DC

MEETING REPORT

Marc S. Allen	Andrew B. Christensen
Executive Secretary	Chair

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
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MEETING MINUTES
TABLE OF CONTENTS

Meeting Report Prepared By:
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Tuesday, March 5

Welcome and Chair's Remarks

Dr. Andrew Christensen, Chair of the SScAC, called the meeting to order and welcomed members and attendees. After introduction of new members, Dr. Marc Allen, Designated Federal Official, reviewed logistics and the agenda. He noted that Dr. Ed Weiler, the Associate Administrator of the Office of Space Science (OSS), would be joining the committee on Thursday morning. Dr. Christensen noted that the NASA Advisory Council (NAC) had met the previous week to discuss the International Space Station (ISS). He noted that Administrator O'Keefe had commented to the NAC that it was not currently possible to estimate the run out cost of the Space Station, and offered to provide a copy of the Administrator's remarks from that meeting. At the next NAC, Dr. Christensen will report on the SScAC deliberations.

OSS Budget and Status Overview

On behalf of Dr. Weiler, Dr. Guenter Riegler, Executive Director for Science, presented the OSS budget and status. He noted two new NASA appointments—the Associate Administrator for the Office of Space Flight (OSF), Dr. Frederick Gregory; and the Associate Administrator for the Office of Biological and Physical Research (OBPR), Ms. Mary Kicza. Dr. Shannon Lucid will be the new Chief Scientist after Dr. Kathie Olsen moves to the Office of Science and Technology Policy (OSTP). Dr. Riegler noted that at the last meeting, there was some concern regarding technology coordination among the themes and with the Office of Aerospace Technology (OAT). This area is important to OSS. Cross-divisional technology issues are being identified in the roadmapping process and coordinated by the OSS Division Directors and Technology Director in quarterly meetings. The final integrated technology plan will be used to leverage external funding sources.

Overall, the FY03 Space Science budget increased by $682 million. The Nuclear Systems Initiative (NSI) was approved. The Europa mission was canceled, but was replaced by a New Frontiers Program. The Deep Space Network (DSN) budget is being transferred to OSS beginning in FY03. In a highly constrained budgetary environment, OSS emerged with a much more robust program and budget. Dr. Riegler showed the overall NASA budget run out. Over the budget run out timeframe (FY03 through FY07), Space Flight is declining and Space Science is increasing dramatically. In response to a question, Dr. Riegler indicated that the FY03 budget numbers include civil servant and institutional costs. The largest component of the Space Science budget is the planetary budget. Dr. Riegler showed the FY03 budget breakdown by development programs (major missions), mission operations, the technology program, the research program, and institutional support. He noted the major changes in content from last year's budget. The largest single change was the bookkeeping of funds for DSN (transfer from OSF to OSS). Proposed funding for the New Frontiers Program and the NSI begins in FY03. As noted earlier, Europa Orbiter was canceled; the Full-sky Astrometric Mapping Explorer (FAME) was not confirmed. The NSI will enable a new strategic approach to planetary exploration and is likely to play a key role in NASA's future. Safety is the highest priority. There are three components: nuclear fission electric propulsion; nuclear fission power; and power development for the Mars '09 and planetary exploration. This initiative is in addition to the In-Space Propulsion Program already in the baseline. Nuclear electric propulsion will enable entire new classes of planetary exploration missions. The nuclear power program will increase the operational lifetime and productivity of spacecraft and instruments.

The Outer Planets Program was eliminated due to cost growth. The New Horizons Pluto mission is only funded in FY02. There is no additional funding for this mission in the proposed FY03 budget. The New Frontiers program is included in the FY03 budget and will be run along the lines of Discovery. The goals and science priorities will be responsive to the new planetary decadal survey and the OSS Strategic Plan. Mission selections will be through a fully open and competitive process. Costs will be capped at $650 million per mission. In response to a question, Dr. Riegler noted that Dr. Weiler's policy of having at least one mission at JPL is an issue that is not resolved. However, JPL is confident that it is in a competitive posture for future missions. The current Hubble Space Telescope (HST) Servicing Mission (SM) is going

well. The proposed budget supports SM-4 as the final servicing mission in 2004. The HST return to Earth is planned for 2010. As HST funding decreases, NGST funding increases. This principle is being supported by the Administration. The Space Operations Management Office (SOMO) and DSN issue is being resolved, in part, by transfer of the management and budget to OSS. No new major SOMO problems have surfaced. Three major missions in development continue to have problems: the Space Infrared Telescope Facility (SIRTF) (cost and schedule); Gravity Probe (GP)-B (cost and schedule); and the Stratospheric Observatory for Infrared Astronomy (SOFIA) (schedule). In addition, several Discovery, Explorer, and New Millennium Program (NMP) missions show signs of cost growth. OSS is expected to manage within its budget. To the extent that additional funds have to be applied to these or other missions, other elements of the OSS program will be reduced or eliminated. Dr. Riegler showed that 92% of the R&D budget is competed. Some of the SScAC members felt that the chart was misleading and did not reflected the reality of the current investments. Dr. Riegler noted that Dr. Weiler has asked the OSS staff to take a more detailed look at the budget and the degree of competition. The SScAC identified this as an issue for further discussion.

Dr. Riegler discussed the schedule for Announcement of Opportunity (AO) releases and selections over the rest of the year. An amendment to the Research Opportunities in Space Science (ROSS) 2002 for in-space propulsion technology will be issued in a few weeks. There will be a number of space science launches over CY02 and CY03. With respect to metrics, NASA had over 8% of the top *Science News* science results worldwide in 2001. Space Science was 83% of the NASA component. Dr. Papike expressed concern over the effect of OSF (Space Station) on OSS. Dr. McComas observed that the manned program has almost no visibility with respect to science results. He was concerned about using the *Science News* metric as a measure of science productivity without knowing more about the criteria that *Science News* uses. Dr. Riegler agreed that this can be a rather poor parameter, but no one has come up with a better one. OSS is also collecting news stories that appear in the popular press (*New York Times, Washington Post*, etc.). Dr. Allen noted that the *Science News* measure is both quantitative and independent. Measures for the Government Performance and Results Act (GPRA) are subject to audit, and it is not easy to get both quantitative and independent measures. Dr. Dressler commented that he thought that *Science News* is a proper source—academic measures are not as relevant for this purpose.

Discussion:
In response to a question regarding Explorer, Dr. Riegler noted that the Swift gamma ray burst mission has some budget problems. Dr. Hertz observed that the Explorer missions frequently push up against the mission cap.

Dr. Akin raised the issue of technology concerns. He commented that the presentation did not appear to be responsive to the SScAC concerns; technology investment and coordination are still open issues, particularly with respect to OAT. This was tagged as an item for the next meeting.

Dr. Papike expressed concern about the lack of a robust program supporting ground equipment and facilities, e.g., to study samples. There is a feedback loop from studying materials and samples to future mission design. Dr. Riegler noted that astrobiology is sufficiently broad to address equipment. OMB is still watching the issue of collaboration between the National Science Foundation (NSF) and NASA in astronomy. It has directed NASA and NSF to convene an advisory group that advises both agencies. To respond to this, NASA will not convene a separate panel; rather, some members of the SScAC and subcommittees will be asked to serve on a new joint advisory group. This joint advisory group will advise on issues of NASA/NSF overlaps or gaps, the National Virtual Observatory (NVO), and other issues for the FY04 budget. Areas that are not adequately covered, e.g., Research and Analysis (R&A), will be addressed in the roadmap process. Some missions have joint sponsorship of ground-based observations; others do not, and these observations fall into a "gap" between NASA and NSF. Dr. Hertz added that solutions need to be brought through the various observatory working groups. Dr. Drake suggested that the SScAC have something on the record on this issue. Dr. Christensen suggested that the committee obtain more insight into the problem before making a statement, and this was put on the "list" as an item for the next meeting. Dr. Christensen observed that the Space Science budget has seen a remarkable turnaround; it is now increasing rather than flat or declining. NASA is making an impact with Congress and OMB.

In response to a question, Dr. Riegler provided details on the budget increases in the Discovery Program and the Explorer Program. Dr. Papike suggested a simple spreadsheet showing cycle times, budget caps and rationale, scope, status of discovery, etc. for the Discovery, Explorer, Scout, and New Frontiers Programs.

Dr. Allen indicated that in June, the committee would get a preliminary briefing on the roadmaps from the subcommittees. The internal OSS roadmaps should be addressing technology coordination. Dr. Kolb indicated that his roadmap team believes that technology is being adequately coordinated, at least within Astronomy and Physics. Dr. Akin added that inter-Enterprise coordination has been a concern, and there is a lot of money going into technology in OAT. The SScAC should get a briefing on the coordination of technology between OSS and OAT. Dr. Christensen requested this for the next meeting. Dr. Allen stated that one of the things that could be considered for the November strategic planning workshop would be a half-day on technology coordination.

Annual Ethics Briefing

Ms. Laurie Rafferty, NASA Senior Ethics Attorney, gave the SScAC members their annual ethics briefing as required by the Federal Advisory Committee Act (FACA). She reviewed the legal requirements for advisory committees and the different statutes that affect the SScAC members as Special Government Employees (SGEs). A question was raised about whether "preparation meetings" for a formal FACA meeting, e.g., a subcommittee, could be held as non-FACA meetings. Mr. Rafferty indicated that she would research this and provide an answer to the SScAC. There was some discussion on when members should recuse themselves when certain matters were brought up before the committee. Dr. Allen noted that this committee is typically not involved in recommending a selection. If there are general policy questions about the grants program, the members are too far removed from a "particular matter" and it is too speculative for the conflict of interest statute to come into play. Ms. Rafferty suggested that if there are any questions about the applicability of the statutes, the members should contact the General Counsel's office. Although post-employment restrictions apply to SGE's, most advisory committee members are not personally and substantially involved in particular matters, e.g., selection of grants, as part of their government service. All of these statutes require participation in a particular matter to trigger restrictions. For the normal scope and charter of advisory committees, general advice and recommendations on a program are not sufficient to trigger conflict of interest. Ms. Rafferty provided a list of contacts in the General Counsel office for any questions related to these statutes.

Dr. Gulio Varsi briefed the SScAC on a process and schedule for space science-relevant OAT technology tasks and plans for co-management of existing technology tasks under OAT's Pioneering Revolutionary Technology (PRT) Program. This cooperative activity was initiated to support OSS's long-range technology goals. Dr. Thronson indicated that the purpose of this process is not an external peer review of the tasks. If the technologies that OAT is supporting are attractive to OSS missions, the relevant division will undertake a standard peer-reviewed solicitation later. One of the questions was how OSS determines that the mapping is correct. Dr. Thronson noted that until now, there has been little or no influence on OAT tasks. In future years (or later this year), OSS will reverse the process and put it in the proper order, i.e., mission priorities will redirect the OAT funding to address the mission goals. Other Enterprises have been invited to participate in the PRT Program, but OSS has taken the lead. OS division theme technologists have spent of lot of time reviewing the OAT tasks and activities. At the next meeting in August, the results can be presented.

Nuclear Systems Initiative (NSI)

Dr. Thronson provided a top-level overview of the NSI. Details of the program are being worked and can be presented to the SScAC at its next meeting. The NSI consists of two components: the Radioisotope Power Systems (RPS) initiative to improve the efficiency of current systems and to develop and deliver RPS units; and a Nuclear Power and Propulsion Technology research program for space fission reactors. Nuclear power can supply high-sustained power for long duration. The objective of the RPS is to enable missions where solar power is not feasible, e.g., a robust Mars robotic exploration program over the entire planet's surface. RPS is a requirement for missions to outer planets. This program is primarily an improvement upon known technologies. It is about $500 million over five years. The biggest technology

development will be improving the power conversion system. About 30 RPS have been launched by NASA; none of the radioisotope systems have had a problem. The objective of the Nuclear Power and Propulsion Program is to enable a new class of missions. This Program is also about $500 million over five years. It is a technology program; a subsequent initiative will be a flight program. The Russians have had extensive experience with one type of fission reactor in space, and over 30 reactors have flown in Earth orbit. NASA would not use fission reactors in low Earth orbit. Dr. Thronson discussed the basic technology components of the two systems and showed the status of RPS technology. There are a few fission reactor options and a lot of concepts are being studied. A single design is not on the table. Safety is paramount. New designs will reduce the amount of plutonium for a given electrical output. The entire system will be carefully designed to withstand credible failure of the launch system. The Nuclear Fission (uranium) System will be designed to remain subcritical under all credible launch accident scenarios. The reactor will be started only after reaching stable orbit or Earth escape. In response to a question, Dr. Thronson noted that DOE is charged with supporting the infrastructure for use of nuclear fuels in space. DOE will be in charge of the nuclear materials and the technology elements that contain and hold it (about $30 million per year). All of the "new" money for this will be at NASA.

Astronomy and Physics (A&P) Division

On behalf of Dr. Anne Kinney, Dr. Paul Hertz gave the report for the A&P Division. He reviewed the operating missions and the upcoming launches over the next three years. The Far Ultraviolet Spectroscopic Explorer (FUSE) has resumed science operations. The cost of recovery is about $3 million. Chandra is operating well. Last year, it had about 80% as many science stories as HST. The Microwave Anisotropy Probe (MAP) went into full science operations in October 2001. After six months of operations, data collection will be "frozen." MAP results should be ready in about nine months. Almost all of the OSS launches this year are A&P missions. The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) is the remaining University Explorer (UNEX) mission that is in development. This mission is behind schedule and is working hard to catch up. The co-manifested mission is experiencing delays. GP-B and Integral (ESA) are launching this year. SIRTF has slipped until early next year. SOFIA was originally planned to start flight in late 2001/early 2002. It has slipped three years due to cost. SOFIA cost growth will use up about three years of operation funds. The next call for instruments has been delayed several years. Dr. Hertz showed the "lien list" for the division. SIRTF has had serious cost overruns, many of which have been due to flight software. GP-B is managing with no contingencies. The Shuttle delay impacted HST costs. Although there has been technical success with Planck, the ESA part of the mission will be much more difficult than originally scoped. The Balloon Program budget was not enough to sustain the infrastructure over the long-term. The Next Generation Space Telescope (NGST) will be more expensive than originally planned. Solving these budget problems (and others within OSS) includes having a ground-based technology demonstration program for Starlight (rather than a flight demonstration) and termination of FAME. Dr. McComas expressed dismay that funds freed from the FAME cancellation were not applied specifically to the Explorer Program. Dr. Hertz provided additional detail on the status of SIRTF, Planck, GP-B, and FUSE. A number of major missions are within a year of launch and problems have to be solved. These problems will be solved within the A&P Division, but no further cancellations are anticipated.

Structure and Evolution of the Universe Subcommittee (SEUS) Report

Dr. Kolb reported on the SEU theme and the SEUS. The subcommittee has a number of new members. The last meeting was December 3-4; the next meeting is April 9-10 in Washington. There are no new issues. SEU has six operating missions: Chandra, High Energy Transient Explorer (HETE)-2, MAP, Rossi X-ray Timing Explorer (RXTE), Submillimeter Wave Astronomy Satellite (SWAS), and ESA's X-ray Multiple Mirror (XMM). In 2002 and 2003, at least five SEU missions will be launched. The 2000 Roadmap contained three near-term future missions: the Gamma-ray Large Area Space Telescope (GLAST), Constellation X (Con-X), and the Laser Interferometer Space Antenna (LISA). The 2003 Roadmap is being developed by a Roadmap Team overlapping with SEUS. The roadmap will be aligned with the NAS Committee on Gravitational Physics, the NAS Physics Survey Overview Committee, the NAS Astronomy and Astrophysics Survey Committee, and the NAS Committee on Physics of the Universe. There have been several roadmap meetings, and the team will meet again before the next SEUS meeting. The draft priorities will be presented to SEUS. The SEU Team solicited white papers from the community for mission concepts.

Origins Subcommittee (OS) Report

Dr. Alan Dressler reported on the OS meeting that was held the previous week. The subcommittee received an update on Origins missions, a progress report on the Wide Field (WF)-3 Camera on HST, a status report on Kepler, and a description of the science program of FAME. It also prepared for a 2-day roadmap workshop. One other problem has arisen on SIRTF—the mid-IR camera. This is a loss of science, but it is a loss of quantity rather than quality. Starlight has been turned into a ground program. This was a technology precursor to Terrestrial Planet Finder (TPF), and the question of what TPF will be is not certain. The WF-3 Camera is on schedule and budget at this time. Kepler was selected as a Discovery mission. This addresses a major concern that the Origins program is dominated by large, strategic missions. There is much science that can be done with smaller missions such as Kepler. Kepler will monitor 100,000 solar types and determine the frequency of planets from Jupiter-size down to Earth-size. There will be no new technology development on this mission. Although some of the FAME science can be recovered with the Space Interferometry Mission (SIM), the much smaller number of targets will restrict large survey projects. In addition to science that was intended to serve as a foundation for SIM, there are other consequences for Origins science. FAME would have provided an important base for many future Origins investigations. With respect to the Origins roadmap, the basic goals have not changed since 2000. Origins has an approved line in the budget and there is a framework within which to work. There are many new results in galaxy evolution and planets that require a fresh look at the supporting work. TPF is evolving rapidly. Two design alternatives will be selected and researched in the next few years. The OS also heard an inspiring presentation on how a layered approach and simple English can be used to make a much more effective presentation of the roadmap. The 2000 Astrobiology Roadmap will be used as a model. Two issues came up at the OS meeting: the process for proposed missions that are not part of the theme that was sold to OMB and Congress (e.g., the Single Aperture Far-IR Telescope (SAFIR), which was recommended by the Decadal Survey for implementation in this decade); and the slogan "all roads lead to TPF." Although technology development needs to come first, the OS thinks that it would be good to understand how new missions will be incorporated into the new A&P division with its two themes. The OS is very concerned about the future of Origins—will it evolve to just planets and life? Dr. Drake noted that the SSE theme has a similar problem—the "top down" process for a funding initiative can become a limiting factor.

Education and Public Outreach (EPO) Report

Dr. Jeff Rosendhal reported on the EPO program and provided an update on what is going on across the board in education. Dr. Rosendhal distributed the latest edition of the EPO Newsletter, and noted that products like these are accessible on the Internet. OSS is in the process of putting together a 2001 annual report. There are two areas where NASA could have direct benefit to the public: technology and economic benefit; and education. These issues have become more important over the last 8 or 9 years. The Hart-Rudman Report identified education as a national security imperative, and what NASA is doing is still relevant to the mainstream concerns of the nation. In EPO, OSS's goal is to share the excitement of space science discoveries with the public, enhance the quality of science, mathematics, and technology education, particularly at the pre-college level, and help create a 21st century scientific and technical workforce. One hundred fifteen separate programs are now underway. Over 400 EPO activities and new products are associated with these programs. A number of awards and medals have been given for OSS EPO activities. Large numbers of participants (over 200,000) are being reached directly. Over 50 million Internet participants are being reached with web casts, web chats, and other web events. Over 100 missions and programs contributed to the OSS EPO Program in FY01. Dr. Rosendhal showed some of the EPO partners and events in FY01. OSS has been working with a number of professional organizations. One of the new directions has been to get involved in community groups, e.g., the Girl Scouts and Boys and Girls Clubs. Some programs are directed toward formal education; some are directed more toward community-based events. Enormous leveraging is possible through strategic alliances nationwide. An increasingly rich portfolio of educational products is being developed. The Space Science Resource Directory is a convenient way to find NASA Space Science education products for use in classrooms, science museums, etc. Dr. Rosendhal discussed the minority university initiative. The goals are to enhance the academic capabilities at minority institutions and increase the understanding of science, technology, and the role of research by a diverse segment of the population. Fifteen minority institutions were selected to receive NASA funding. To assess quality, OSS is introducing a formal Product Review Process. A leading external group in educational evaluation has been enlisted to evaluate the program and progress towards

goals. In addition, a SScAC EPO Task Force has been chartered and three meetings have been scheduled for April through August. Dr. Rosendhal highlighted the membership. The first OSS Education Conference has been rescheduled for June 12-14, 2002, in Chicago. The second meeting of the Task Force will be folded around this conference. In response to a question, Dr. Rosendhal noted that a lot of activity is directed at students doing real science with real data. The "outside of school" experiences turn out to be very important. One thing that OSS EPO can do is to develop a way to have products (e.g., written materials) that are useful to all schools and all teachers. OSS EPO is considering running some pilot programs that are collaborations between astronomy departments and departments of education. For example, JPL is setting up a program with the California state system, a major producer of teachers for the nation.

Wednesday, March 6

Mars Exploration Program

Mr. Orlando Figueroa gave a status report on the Mars Exploration Program (MEP). The President's Budget focuses on this decade with a replanning effort for the next decade. The second extension of Mars Global Surveyor (MGS) has been approved. Odyssey is fully funded. Mars Exploration Rovers (MER) are still scheduled for launch in 2003. Mars Reconnaissance Orbiter (MRO) has had a complete systems requirement review and all contracts are proceeding. The mission is very mature for the end of Phase A and is well in hand. The Scout AO will be released this April. This AO is built from the Discovery template. Key features are outlined on the website. About $325 million is being allocated for this work. The 2009 Mars Smart Lander is baselined as nuclear powered—by a "repackaged" radioisotope thermoelectric generator (RTG) from the Cassini heritage. In response to a question, Mr. Figueroa noted that both solar and nuclear studies are currently being pursued. A decision will have to be made next year. The backup mission would be solar. Dr. McComas expressed concern about the risks involved in pursuing a nuclear mission—this RTG has not been flown and there are socio-political issues associated with flying nuclear devices. Dr. Garvin, the MEP Scientist, noted that the Science Definition Team has assessed this mission and finds that the science goals could be met with a nuclear mission. Mr. Figueroa stated that the base technology has been augmented, and some of the priorities in the technology line are being revisited, particularly some of the instruments. The Mars Instrument Development Program creates a bridge between the low technology readiness level (TRL) and mission requirements. The base technology program has several sub-lines—instruments is one of these. R&A is 1% of the Program in FY02, building to 1.7% by FY04.

Mr. Figueroa provided a short history of MER and reviewed the current status. The biggest issue is cost; there are technical and workforce safety issues, but the program believes that these are workable. The project will need resources beyond the $50 million increase allocated by the program last fall, but the program is committed to finding a solution to budget issues without impacting other missions. An additional $20-$30 million can come out of program FY02 and FY03 reserves; any impact greater than $30 million may require cancellation of the second launch vehicle. This would generate about $57 million if the decision is made by May 2002. In response to a question, Mr. Figueroa indicated that there is a 2005 launch opportunity, but it would require a larger launch vehicle. A 2004 launch is possible, but it would reduce the science return. Dr. Figueroa agreed that workforce fatigue is an important issue, and it is being monitored carefully. Dr. McComas expressed continued concern about the risks associated with cost, technical, and schedule. He felt that the SScAC had not been given enough information at this meeting to provide well-informed advice. Dr. Drake indicated that the SSES reviewed the Mars Program in detail at its meeting the previous week and felt that although the project is facing challenges, everything that can be done is being done.

Mr. Figueroa reviewed the international collaborations on the program through the 2009 missions. He emphasized that the program is focusing on having a solution to every mission (a "stand-alone" approach). Funding for future missions (beyond 2009) and sample handling line items have been removed from the budget. Future funds will depend on results from this decade's missions and whether NASA can develop an "option-driven plan" for the next decade. It is critical that the plans include options other than sample return, given its expense, the uncertainty of Mars discoveries during this decade, and technological

advances achieved. Mr. Figueroa showed the timeline for development of the planning template for the second decade of Mars exploration.

Dr. Garvin summarized the results of the February 2002 Mars Exploration Program Analysis Group (MEPAG) international meeting. The MEPAG now reports to the Program Director and Program Scientist and provides briefings at the Solar System Exploration Subcommittee (SSES) meetings. The primary discussions revolved around the Federal budget passback, how the international scientific community should interact, the importance of the Mars Smart Lander, Mars Scouts, and priorities for exploration in the second decade. The biggest consequence of the meeting was the spawning of three science groups: Mars Sample Return (MSR); future pathways; and Astrobiology. After review of MSR assessments and extensive discussion, the MSR science group agreed that the mission still has scientific credibility with a reduced science floor. Sample return continues to be endorsed by a wide spectrum of Mars scientists. Four industry estimates of mission cost range from $1.6 billion to $2.4 billion. The MSR science group will be evaluating scientific credibility of a lower science floor and potential cost savings. Draft results are due by June 2002. The future pathways science group tentatively identified three major pathways: relatively early MSR; in situ with a sub-surface theme; and a broad program focused on understanding climate and geological cycles. These threads will be further discussed over the next few months. In closing, Dr. Galvin summarized the current state of Mars science. He noted that the Web site has a summary of all of the missions: http://www.mars.jpl.nasa.gov.

Solar System Exploration (SSE) Division Update

Dr. Colleen Hartman provided an update on the SSE Division. She reviewed where the program was in November 2001 compared with the present. In response to a question, she indicated that OMB felt that there was disarray in the Outer Planets Program, as well as cost overruns. This was the reason that Europa Orbiter and Pluto Kuiper Express (PKE) were canceled. Dr. Drake observed that there is also a political battle between OMB and the Congress. The White House rated Discovery and Explorers as effective and the Outer Planets Program as ineffective. OMB continues to emphasize the importance of Origins. New Frontiers will be run similar to Discovery, with some important differences. It must be open for good ideas, but with a set of prioritized missions. The set is dependent upon the Decadal Survey results. The AO should be released this summer. Funding will provide one award every three years. Outer Planets funding was used for New Frontiers, but New Frontiers is not just for outer planets; it is for solar system exploration (every target except Mars). Mission costs, including launch, is capped at $650 million. Each mission must launch within 47 months from start of development. The multi-mission RTGs will be available to the New Frontiers Program, but the Program will not be held up for them. Dr. Hartman reviewed the status of the plutonium fuel supply. Russian fuel will be purchased under the extension of the existing contract, but DOE regulations require a new contract after 2002. Domestic production is expected to restart in FY09. Dr. Hartman described the advantages of using advanced RPS in Europa in situ exploration and Titan in situ exploration. She compared Mars RPS needs with Outer Planets RPS needs. A Mars RPS design will function for outer planets, but not vice versa without significant redesign. In response to a question, Dr. Hartman noted that inhalation of vaporized or pulverized portions of plutonium are dangerous; other types of contact are not. Both plutonium and uranium are completely contained, and all failure modes have been analyzed. Container devices can sustain every destruction scenario. Dr. Hartman discussed how Galileo and Jupiter's moons could be explored with nuclear electric power (NEP). She emphasized that the NSI is a technology development program; there is no in-space flight test of NEP in the NSI. The Division will create a NSI Science Definition Team for NSI; however, there will be a closer coupling between the technologists and the scientists.

With respect to the FY03 President's budget, SSE did very well. There is an augmented Astrobiology Science and Technology for Exploring Planets (ASTEP) program. The R&A increase is slightly above the cost-of-living increase. DSN is now in the SSE Division, with cross-divisional responsibilities. OMB has requested that NASA develop options for the next decade of Mars. With respect to mission status, two missions (Rosetta and Pluto) are red; Genesis is rated yellow. Rosetta is red because of underscoping of the effort at JPL. Pluto Kuiper Belt (PKB) is red because of uncertainty with the current cost profile. Langley Research Center is taking an independent look at PKB costs. Although there is $30 million in FY02 for New Horizons Pluto, there is no out-year funding. Genesis is yellow because thermal monitoring with the batteries continues. Everything else is green and is going well. Dawn was selected as Discovery 9. It is

the first Solar Electric Propulsion mission. Keplar was selected as Discovery 10, but is delayed one year. There is not enough money in Discovery to do two missions at one time, and the mission without launch constraints (Kepler) was delayed. High priority technologies for in-space propulsion will be openly competed. The current NASA Research Announcement (NRA) closes in March. Operating missions are all green. The FY03 budget reflects a 73% increase for planetary missions from FY02 to FY07. There was a 43% increase from FY02 to FY03. Even without the New Frontiers Program and NSI, the growth would be 5%, more than double the rate of most other government programs. In conclusion, Dr. Hartman reviewed the current status of personnel in the SSE Division. Dr. Sellgren suggested that the job announcements "translate" the GS-level being advertised, e.g., poct-docs with two years for GS-13. In response to a question, Dr. Hartman noted that there are four new positions (engineers) to be hired immediately for the NSI. Dr. Farmer praised Dr. Hartman's presentation and noted that her approach provided the right level of detail for the SScAC.

SSES Report

Dr. Michael Drake reported on the SSES meeting the previous week. The SSES noted that the President's budget is very generous for SSE; however, the Pluto and Europa missions were canceled. The SSES felt that the NSI is a very good idea and fully supported it. The SSES was pleased with New Frontiers as a line; however, it presents a problem. Most scientists don't believe Europa Orbiter could be done for $650 million, and that implies that most missions to the outer planets could not be done for this amount. New Frontiers needs to be augmented to provide for New Horizons. There is a huge ground swell of support for Pluto, and Pluto remains the highest outer planets priority for SSES. As noted earlier, the SSES received a detailed briefing on the Mars Program. Mars Surveyor and Odyssey are returning very exciting science. MERs are on track, although the budget and schedule are tight. Competed opportunities will be available under the Scout Program. There is a significant amount of money going into R&A for Mars. International cooperation is enabling, but at the same time, these cooperations complicate issues. The French and Italians will be included in a formal way in planning and the MEPAG. Unfortunately, Mars sample handling was terminated pending further study. This violates the philosophy that Mr. Scott Hubbard had formulated: current missions will be used to plan future missions. Another problem was that the community did not speak with one voice with respect to sample return. There is a big question whether NASA can do a sample return, and the examination of options for the second decade must be done very carefully. One of the challenges is how to keep the program focused in a way that is consistent with budget, OMB and Congress, and the Mars community. The program could change dramatically with discoveries by intervening missions. The SSES received a telecon report from the Astrobiology Task Force. Issues were: the process for selecting a new Director for the NASA Astrobiology Institute (NAI); a visiting committee on 5 year centers; the balance between NAI and the exobiology research program; and whether the NASA Specialized Center on Research and Training (NSCORT) should be folded into the NAI. With respect to roadmap planning, the intellectual goals of the roadmap will be: planetary origins; planetary evolution; and habitability. Folded into these will be astrobiology, international partnerships, technology, R&A, and EPO. In response to a question about the goals, Dr. Drake noted that "planetary" is rather generic and includes more than just planets. Dr. Farmer was concerned about the way the astrobiology would be folded in. He noted that life issues tend to drive a lot of the rationale at high levels, but the astrobiology community is not as fully engaged as it should be. It is important that astrobiology have good representation in each of the goals. Biology could be brought in to enrich the rationale and the relationships between planetary evolution and life. Dr. Drake agreed with Dr. Farmer's points. He indicated that with respect to the roadmap document, there will be a freestanding page or two on astrobiology at a high level, and it will also be integrated into each of the areas. There is at least one "card-carrying biologist" on the roadmapping team.

Lunch Science Talk

During lunch, the SScAC heard a science talk on (Deep Space) DS-1 from Dr. Robert Nelson. Dr. Nelson discussed the encounter of the spacecraft with the Comet Borrelly, which occurred on September 22, 2001. Twelve technologies, including primary ion propulsion, were successfully tested by DS-1. Technology validation was the primary objective and the first phase of the mission; science was a secondary objective. After completion of the technology validation, there were two very powerful science opportunities for the science phase of the mission: Comet Wilson-Harrington and Comet Borrelly. The star-tracker on the spacecraft failed before reaching Comet Wilson-Harrington, and an alternate strategy was developed to

obtain high-gain antenna capability and a substitute for the star-tracker. The eight-month delay cost the encounter with Comet Wilson-Harrington. Comet Borrelly was the archetype comet that defines its group and has a high scientific priority. The closest approach was about 2000 km on the day side; the encounter was at high speed, fairly close to the Sun. The data clearly distinguished coma from nucleus. The closet approach image obtained was at about 3700 km. It was clear that there are albedo and morphological variations as well as distinct emission regions.

Sun-Earth Connection (SEC) Division Update

Dr. Richard Fisher provided an update on the SEC Division. At the present time, there are two programs: Living With a Star (LWS) and Solar Terrestrial Probes (STP). LWS consists of missions to establish a weather research network for characterization of Sun-Earth system behavior and identification of the critical physics that link parts of the system. STP are missions with focused investigations to explore specific scientific research questions. There are two STP missions under development: the U.S. contribution to Solar-B and the Solar Terrestrial Relations Observatory (STEREO). STEREO will be in confirmation later this month for transition into Phase B. Magnetospheric Multi-Scale (MMS) is the next mission in the line, with an AO anticipated later this spring. STP was intended to have launches every two years. LWS, a new initiative in NASA, includes the Solar Dynamics Laboratory (SDO) as the first mission. LWS will rise to a total expenditure of around $1.3 to $1.5 billion in the first decade. The AO for SDO instrumentation was released in January; proposals are due on April 24, 2002. The Solar Probe mission was canceled, but a study is underway at the Applied Physics Laboratory (APL). Dr. Fisher reviewed the other SEC missions, all of which are green except NMP ST-5, which is yellow due to cost containment issues and launch vehicle commitment. SEC manages other programs for the Agency: Explorers, sounding rockets, and the NMP. At this time, there are no issues on sounding rockets. All operating missions are green except for Yohkoh. Yohkoh lost attitude control on December 15 during an eclipse operation. It was recovered after a long outage and is in a stable configuration but pointed away from the Sun. It is unlikely that it will be recovered. Polar, Wind, and Geotail have undergone senior review to stay under cost capped operations. The Imager for Magnetospheric to Aurora Global Exploration (IMAGE), Cluster, the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, and the High Energy Solar Spectroscopic Imager (HESSI) are in their prime mission phases. Dr. Fisher described the TIMED mission, which was launched in December 2001, and went into mission operations in January. Science will be forthcoming. HESSI was launched from a Pegasus without difficulty and has operated very well since then. Dr. Fisher showed a schematic of SEC missions from 1998 to 2018. Candidate geospace missions are being identified for the next solar maximum. In response to a question, Dr. Fisher noted that there is some overlap with Earth science missions with respect to climate and atmosphere. Both LWS and STP missions have similar caps--$350 to $400 million. Dr. McComas noted that STP was drawn broadly enough to include all of the basic research in the SEC theme. Dr. Dressler noted parallels between STP/LWS and SEUS/Origins. By analogy with SEU, Dr. Fisher remarked that stellar images might help resolve issues of convectional and rotating magnetized plasmas.

Sun-Earth Connection Advisory Subcommittee (SECAS) Report

Dr. McComas reported on SECAS. The subcommittee meeting was moved to the first week of April. The roadmap process is underway, but is running slightly behind the other activities. The roadmap committee is entirely separate from SECAS, and SECAS functions as the "red team." There will be a community input meeting this week at GSFC. In general, the SEC program is healthy and on track. At the December meeting, there was a lot of discussion on solar sail technology development. This will enable a significant fraction of future missions. The SECAS greatly appreciated inclusion in the ROSS. Space Technology (ST)-7 will be a critical opportunity to prove sail technology. The SECAS reiterated its strongest support for Solar Probe. (Dr. McComas noted that he has abstained from discussions on this topic because of his involvement in the projects.) There is an urgent need to find a way to implement Solar Probe. For three decades, this mission has been at the top of the list intellectually as well as scientifically. In response to a question, Dr. McComas indicated that SEC has never had a Decadal Survey—the first one is underway now. Dr. Judy Karpen noted that the NRC Decadal Survey Committee report will represent Solar Probe as its #1 priority. At the last SECAS meeting, there was a substantial discussion of LWS. SECAS has urged the development of two study teams—a Data Systems Study Team and a Theory and Modeling Definition Study Team. One of the key issues is small launcher access to space. The SECAS is seriously concerned over the future vitality of small launcher capabilities in the U.S, since SEC depends for much of its

strategic mission on regular, reliable, low-cost access to space. A Boeing representative present stated that his company was working with the Office of Space Flight to fly secondary payloads. Dr. McComas requested some help from the SScAC on this issue, and suggested that the SScAC spend some time on this topic at a future meeting. In response to a question, Dr. McComas noted that the SECAS met jointly with the SSES in December. Common interests were identified and discussed. There is joint interest in trying to continue this type of coordination.

General Discussion

Dr. Christensen identified several topics for committee discussion:

1) The role of the flagship missions in the strategic planning activity—Where do the flagship missions fit? How are strategic missions funded? Lines provide much more flexibility; however, NASA will have to "sell" the flagship missions one at a time. Origins was "sold" as something that would continue for decades. Mr. Roy Maizel explained the mission funding structure. The focused theme technology lines contain the strategic missions. Under the SEU theme, there is early funding for Con-X and LISA. At this time, there is not placeholder funding for the outyears. There is a clear understanding with OMB and the Administration that the outyear funding is not there, and that NASA will come back for full funding for those missions. LWS is more like Origins. There are two major lines in SEC (under focused technology)—STP and LWS. There are strategic missions that form the LSW program. Dr. Dressler observed that the SScAC has been using "line" as a placeholder. Mr. Maizel noted that NASA is very careful to say that the purpose of a line is to take the technology to a point where the program is ready to go to full development (or not), and to do a life cycle cost at that time. When a strategic mission is ready to go to development, it will be removed from the focused technology line and will become its own line. LWS was sold and approved two years ago as a major new initiative with a particular profile. NASA agreed to manage within the annual funding limit. SEC has decided on the frequency, and that determines the "cap;" however, SEC could "retime" things and do something bigger. After explanation of the budget structure, the SScAC concluded that there is sufficient latitude for OSS to put things in as they see fit. However, there should be a public letter to the community that describes how things are funded in OSS.

2) NSI: The NSI is more vulnerable than any other element because it is new. Nuclear power and propulsion is an enabling capability for the next decade and beyond. Multi-mission RTGs are enabling for this decade. The SSES strongly supported the NSI. The SScAC endorsed the concept of developing the NSI technology.

3) The SScAC reviewed and discussed the draft comments on the Mars Exploration Program, technology, and EPO.

4) Dr. Christensen presented his draft statement on competed vs. non-competed science, the fact sheet on Discovery, Explorer, etc., and NSF/NASA coordination.

Dr. Farmer raised the issue of the absence of "card carrying biologists" on the subcommittees. This is where the roadmapping exercise is routed and where this participation is needed. Dr. McComas stated that he would be happy to try to get someone on SECAS. Dr. Dressler agreed that the issue of biologists in the subcommittee structure was worth pursuing with OSS. The SScAC recognized that integration of biologists into the subcommittees has been slow, and the SScAC was interested in helping to move it along.

Topics for next meeting include:

- Roadmap reports by subcommittees
- Code R technology briefing
- GPRA assessment
- November workshop and agenda
- AA briefing
- AA report out
- Regular Division and Mars reports
- EPO Task Force status

- NASA/NSF astronomy coordination status
- Small launch systems issues

Thursday, March 7

Report to the Associate Administrator

Dr. Christensen reviewed the committee's discussions, conclusions, and recommendations. He noted the following topics: mission funding structure and how new strategic missions can be accommodated in the various lines with existing cost caps; the committee concerns about the Mars Program; the importance of EPO and the objectives of the newly formed Task Force; and coordination with OAT on technology investment that supports OSS needs. Dr. Christensen reviewed the committee's draft letter's main point, starting with the budget and asking for the "fact sheet." Dr. Weiler gave a history of the idea of "lines." Crediting Dr. Wes Huntress with their invention and their advantages. He said he has no reluctance, however, to go for a new flagship mission if the science is sufficiently strong.

Dr. Christensen asked what Dr. Weiler's expectations from the committee were about Mars. Dr. Weiler noted special task areas covered by task forces (e.g., MEPAG), but went on to say that he expected his division directors and program directors to be candid and that he expects general signals from the committee. He said he believed that Mr. Figureroa was doing a fine job and would make the right tough recommendations. He continued that he didn't believe the committee needed to hear directly from program review teams; if the committee felt that it did, it would be a fundamental message, and should not be necessary if management is doing its job. Dr. Christensen agreed that the SScAC is an advisory committee, not a review board. On MER, Dr. Weiler said he wanted strategic, not tactical advice—don't tell me how many degrees differently to steer, he said, tell me if I am going north instead of south. Dr. Weiler suggested that his managers could provide SScAC with executive summaries of IRT reports, together with what action NASA management is taking in response. Dr. Kolb compared the status of MER today with Mars MCO and MPL projects. Dr. Weiler disagreed, saying that the difference was that, while the MER project is in a tight situation, the previous failed missions didn't know how much trouble they were in, not the case today with MER. Nonetheless, Dr. Weiler admitted that he was concerned. Mr. Kress suggested that the committee's letter include a statement that it is imperative that a rover succeed, and that hard decisions respecting the fate of a second rover should be made as needed to ensure this. Dr. Weiler agreed that he would be interested in this advice.

This was Dr. Papike's last meeting, and Dr. Weiler thanked him for his participation on the SScAC and his contribution to OSS.

The comments, concerns and recommendations are summarized in the letter to the Associate Administrator, included as Appendix D to this report.

FINAL AGENDA

Space Science Advisory Committee

March 5-7, 2002
NASA Headquarters, Washington, DC

Tuesday, March 5 (Room 9H40 *aka* PRC)

8:30	Announcements	A. Christensen
9:00	OSS Budget and Status Overview	G. Riegler
10:30	BREAK	
10:45	Discussion	A. Christensen
11:15	Annual Ethics Briefing	L. Rafferty, Office of the General Counsel
12:00	LUNCH	
1:00	Nuclear Systems Initiative	H. Thronson
1:45	Astronomy and Physics Division presentation and Q&A	P. Hertz
2:45	BREAK	
3:00	SEUS report	E. Kolb
3:30	OS report	A. Dressler
4:00	Discussion	A. Christensen
4:30	EPO report	J. Rosendhal
5:30	ADJOURN	
7:00	Committee Dinner at Sala Thai	

Wednesday, March 6 (Room 9H40 *aka* PRC)

8:30	Chair's summary	A. Christensen
8:45	Mars Exploration Program	O. Figueroa
9:30	Solar System Exploration Division presentation and Q&A	C. Hartman
10:15	BREAK	
10:30	SSES report	M. Drake
11:15	Discussion	A. Christensen
12:00	LUNCH	
	Science Talk: *DS-1 Encounters Comet Borrelly*	R. Nelson, JPL
1:15	Sun-Earth Connection Division presentation and Q&A	R. Fisher
1:45	SECAS report	D. McComas
2:30	Discussion	A. Christensen
3:00	BREAK	
3:15	General Discussion	A. Christensen
5:30	ADJOURN	

Thursday, March 7 (Room 6H46 *aka* MIC6)

8:30	Committee preparation of letter	A. Christensen
9:45	Report to the Associate Administrator	A. Christensen E. Weiler
10:45	Chair's Final Remarks	A. Christensen
11:00	ADJOURN	

SPACE SCIENCE ADVISORY COMMITTEE
Membership List

Andrew B. Christensen (Chair)
NOAA/EUMETSAT

Charles A. Beichman
NASA/Jet Propulsion Laboratory

Michael J. Drake
University of Arizona

Jack D. Farmer
Arizona State University

Roderick A. Heelis
University of Texas at Dallas

Edward W. Kolb
Fermi National Accelerator Laboratory

James J. Papike
University of New Mexico

Maria T. Zuber
Massachusetts Institute of Technology

Marc S. Allen (Executive Secretary)
NASA Headquarters

David L. Akin
University of Maryland

Alok Das
Air Force Research Laboratory/VSC

Alan M. Dressler
Carnegie Observatories

David H. Hathaway
NASA/Marshall Space Flight Center

Paul H. Knappenberger
Adler Planetarium and Astronomy Museum

David J. McComas
Southwest Research Institute

Kristen Sellgren
Ohio State University

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
March 5-7, 2002

MEETING ATTENDEES

Committee Members:

Christensen, Andrew *(Chair)*	NOAA/EUMETSAT
Akin, David	University of Maryland
Allen, Marc *(Executive Secretary)*	NASA Headquarters
Drake, Michael	University of Arizona
Dressler, Alan	Carnegie Observatories
Farmer, Jack	Arizona State University
Hathaway, David	NASA/MSFC
Knappenberger, Paul	Adler Planetarium and Astronomy Museum
Kolb, Edward "Rocky"	Fermi National Laboratory
McComas, David	Southwest Research Institute
Papike, James	University of New Mexico
Sellgren, Kristen	Ohio State University

NASA Attendees:

Beasley, D.	NASA Headquarters
Bergstralh, Jay	NASA Headquarters
Bohlin, Dave	NASA Headquarters
Brody, Steve	NASA Headquarters
Calabrese, Mike	NASA/GSFC
Carroll, Carol	NASA Headquarters
Dakon, Kathy	NASA Headquarters
Figueroa, Orlando	NASA Headquarters
Fisher, Richard	NASA/GSFC
Friedensen, Victoria	NASA Headquarters
Garvin, Jim	NASA Headquarters
Hartman, Colleen	NASA Headquarters
Hertz, Paul	NASA Headquarters
Howard, Rick	NASA Headquarters
Jones, W. Vernon	NASA Headquarters
LaPiana, Lia	NASA Headquarters
Maizel, Roy	NASA Headquarters
Nelson, Robert	NASA/JPL
Norris, Marian	NASA Headquarters
Ormes, Jonathan	NASA/GSFC
Rosendhal, Jeffrey	NASA Headquarters
Rummel, John	NASA Headquarters
Six, Frank	NASA/MSFC
Smith, Eric	NASA Headquarters
Taylor, Ray	NASA Headquarters
Thronson, Harley	NASA Headquarters
Varsi, G.	NASA/JPL
Vondrak, Richard	NASA/GSFC
White, Nick	NASA/GSFC

Other Attendees:

Barentine, J.	BLP
Billings, Linda	Spacehab
Brandinger, Paul	Swales
Burnhma, Mark	California Institute of Technology
Conte, Dom	Spectrum Astro
Dewhurst, Brian	NRC/SSB
DiBiasi, Lamont	L. DiBiasi Associates
Goralczyk, Steve	TRW
Hermann, D.	Brashear LP
Hopkins, Joanne	SRI International
Karpen, Judy	NRL
Kregs, Marty	Battelle
Lettie, Chuck	TRW
Malay, Jon	Ball Aerospace
Mould, Jeremy	NOAO
Nordlund, Frederic	ESA
Ramsey, Becky	DFI
Reichhardt, Tony	Nature Magazine
Richardson, Larry	Boeing
Silver, Matthew	ESA
Stabekis, Perry	Windermere
Van Dorn, Darryl	Boeing

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
March 5-7, 2002

RECOMMENDATIONS

Dr. Edward Weiler March 25, 2002
Associate Administrator for Space Science
NASA Headquarters
Washington, DC 20546

Dear Ed:

The Space Science Advisory Committee (SScAC) met at NASA Headquarters on March 5-7, 2002. Our findings and recommendations from this meeting are summarized below.

This was my first meeting as chair and although I came with great apprehension, it turned out to be a wonderful experience. The committee members are to be thanked for their friendship and willingness to share their experiences and perspectives. For myself and insofar as I can speak for other members of the committee, we are glad to work for the advancement of science within the NASA framework and programs. It is our honor to serve as we can and remain open to suggestions of how to improve our effectiveness as we look forward to help you do the same.

FY2003 Budget Presentation

Guenter Riegler reviewed the key features of the FY 2003 President's Budget. We were delighted to see the proposed increase in the 5-yr run-out rate for the OSS budget. We interpret this as concrete evidence for the strength of OSS programs and the outstanding leadership provided by you and your staff. We noted that the growth of the program exceeds inflation. The out-year projections are very encouraging but we know how fragile they are in reality. We are hopeful that this budget will translate into a continuation of the excellent research that has become a hallmark of space science projects in OSS.

We questioned the reasons for the apparent decreases in the Discovery and Explorer Programs in FY03. We understand that, regardless of near term adjustments, both

programs and the New Frontiers mission lines are slated for substantial growth through 2007. The SScAC reiterates its strongest support for these fully competed lines.

As part of his presentation, Dr. Riegler showed a pie chart of competed versus non-competed expenditures in the R&A budget category. The committee feels that this chart is misleading and exaggerates the actual amount of competed funds. SScAC suggests that it be revised in view of the importance of this issue to policy makers and the scientific community.

During the discussion period, we encountered the issue of funding of research that fell between NSF and NASA jurisdiction, including programs like NVO, ground-based observations in support of past, present, or future NASA missions, and analytical facilities. The committee would like to be kept informed about the developments generated by the National Astronomy and Astrophysics Advisory Committee. We understand that a headquarters committee has been designated to discuss issues with NSF in the near future. The committee would like to have a briefing of the results of that meeting and to engage in a general discussion of the issues with you and your staff at a future SScAC meeting.

Technology Follow-up

One of the main topics of discussion at the December SScAC meeting was the technology planning process within OSS. Although we had not scheduled a technology presentation at this meeting, there was a strong desire to follow up on the topic. Harley Thronson agreed to provide an impromptu update on discussions between Code R and Code S.

The SScAC thanks Harley Thronson and the rest of the OSS technology team for aggressively pursuing a joint technology utilization program to help leverage NASA's investment in technology development managed by Code R. The portion of the funds intended to support OSS needs was stated to be ~40% of the $254M Pioneering Revolutionary Technology (PRT) program. In view of the significant impact of Code R investment on technology relevant to future Code S missions, we would appreciate additional insight into the selection and review processes used by Code R to manage these programs. As a first step in gaining insight into this cooperation, the SScAC requests detailed briefings from the Code R managers at our June meeting, summarizing the content of this program and the match-up between needs and funded technology development. These briefings should also include information on any other cooperative arrangements with agencies such as the DoD and DoE.

Mars Exploration Program

The SScAC heard a report on the status of the Mars Exploration Program from the Director, Orlando Figueroa. Based on the remarkable success of MGS and Mars Odyssey missions, it is clear that the MEP has embarked on an exciting decade of exploration that promises to dramatically improve our understanding of Mars as a planet.

The Committee was pleased to learn that the R&A budget for Mars will increase from 1% in FY02 to 1.7% by FY04. We also appreciate MEP efforts to obtain a more accurate risk assessment for the 2003 MER mission.

The MER mission is aggressively scheduled and Orlando's presentation identified clear warning signs (cost, schedule, workforce safety) that suggest that MER is dangerously close to a path of significant risk. While we are encouraged by the fact that MER is managed by people who are willing to make hard decisions, the SScAC strongly cautions against pushing risks to an unacceptable level, a path the MEP has been down before. SScAC believes that the success of a single rover mission is of the highest priority and the entire program should not be put at risk if a second MER places impossible strains in budget or schedule.

Nuclear Systems Initiative

The Committee was pleased to learn about plans for the Nuclear Systems Initiative in the President's FY03 budget. The Committee recognizes that development of new power and propulsion sources will provide fundamental technologies that will enable new exciting possibilities in the space program. SScAC fully supports the objectives of the initiative. We urge the Office of Space Science to nurture this technology development effort. Radioisotope power systems and nuclear power and propulsion technology are crucial enabling technologies that are sure to lead to new paradigms for space science exploration in the next decade.

The Committee also recognizes the need for Multiple Mission Radioisotope Thermoelectric Generator for Mars missions in this decade.

E/PO

Jeff Rosendhal provided the committee an enthusiastic update on E/PO efforts within OSS. It has been several years since the committee received an update from Jeff, and clearly significant progress in reaching the public has been achieved through his leadership and dedication. We encourage E/PO efforts to reach disadvantaged K-12 communities. The committee looks forward to the results of the Task Force that will be meeting during the next few months to help evaluate how well OSS has carried out its E/PO Implementation Plan to reach the public and influence education.

OSS Thematic Structure and Budget Categories

The Code-S structure contains elements that are managerial, programmatic, and thematic. There are three divisions containing four scientific themes, three funding lines, and multiple initiatives. The current Roadmap process will generate new concepts for missions that will need to be integrated into this structure. It became clear to the SScAC that our community, and indeed the members of the SScAC, barely understand the budgeting system and budget categories. Hence we are unable to explain, for example, how new strategic missions can be accommodated in the various lines with existing cost

caps, and whether new missions can be appended or even inserted (traded) in existing themes such as Origins. We heard a remarkably clear exposition of the mission funding structure from Roy Maizel that convinced us that this information would be of great value to the science community. We request that Marc Allen work with Roy Maizel to prepare a description of the system that we could include in our "community letter" so that our colleagues can benefit from this information. Included in the summary, perhaps in the form of a spreadsheet, would be a guide to the mission lines and initiatives. This includes Discovery, Explorer, Solar Terrestrial Probes, New Horizons, Scout and other flight opportunities. The committee would like to be informed about the reasons for the various cost caps, the various ground rules for science to be addressed, the frequency and other items that distinguish the various mission lines.

Astrobiology

The committee perceives that the integration of biologists into the subcommittee structure has been slow. Given that life is a common thread in Solar System Exploration, Origins and Sun Earth Connection (and has become the unifying concept for the NASA vision and mission statements). The SScAC would like to work toward an improvement in this situation.

Small Launch Vehicles

A concern regarding the status of launch capabilities for small payloads was raised. The Committee requests a briefing at the June meeting regarding NASA plans.

Best Wishes

Andrew B. Christensen
Chair, SScAC

cc: SScAC
M. Allen
J. Alexander
O. Figueroa
R. Fisher
C. Hartman
A. Kinney
H. Thronson
J. Kearns

Dear Colleague,

NASA's Space Science Advisory Committee (SScAC) met in Washington D.C. on March 5-7, 2002. This letter to the community summarizes the key finding and recommendations from the meeting.

The highlight of the meeting was a presentation by Guenter Riegler regarding the Office of Space Science (OSS) budget as contained in the Presidents FY 2003 submission to Congress. There is growth in the budget that exceeds inflation. This is due to the success of NASA's space science programs and reflects the acknowledgement of our scientific endeavors as a priority in the Administration. The out-year projections were very encouraging and will hopefully be accomplished to continue and expand the excellent research that has become a hallmark of the space science projects in OSS.

The budget includes a new Nuclear Systems Initiative that calls for the development of new power and propulsion source technologies. The committee strongly supported the initiative as providing fundamental enabling technologies and expects that the nuclear power capabilities shall lead to new exciting possibilities for future space exploration missions.

Nevertheless, the committee recognized that funding in the out years and especially funding for new initiatives are tentative and fragile. We are hopeful that continued success of OSS missions and recognition of the importance of OSS to the mission of NASA will translate into continued support by the Administration and Congress.

Mars Exploration Program Director, Orlando Figueroa, reported on the status of the Program. We were pleased with the remarkable success of Mars Global Surveyor (MGS) and Mars Odyssey missions which are currently in operation about Mars. However, we remain concerned about the Mars Exploration Rovers mission scheduled for launch in June 2003. There are schedule, cost and workforce safety risks that require attentive management. The SScAC cautioned against pushing risks to an unacceptable level and recognized that the success of a single Rover mission is of the highest priority.

The jurisdictional boundary between NSF and NASA funding was an important topic of discussion. Research that falls between the two agencies, including programs like NVO, ground-based observations in support of past, present, or future NASA missions, and analytical facilities were of concern. It is anticipated that the newly created National Astronomy and Astrophysics Advisory Committee will address such issues. As SScAC receives further information, we will report to the community.

OSS THEMATIC STRUCTURE;

Marc, we wanted to include a discussion of the budget categories in this part of the letter. What is a reasonable estimate of when we might see that?

Sincerely,

Andrew Christensen
Chair, SScAC

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
March 5-7, 2002

LIST OF PRESENTATION MATERIAL[1]

1) FY 2003 President's Budget Key Features [Weiler]
2) Ethics Briefing for Members of the Space Science Advisory Committee [Rafferty]
3) Nuclear Systems Initiative: Presentation to the SScAC [Thronson]
4) Astronomy and Physics Division [Hertz]
5) SEUS Report [Kolb]
6) OS Report [Dressler]
7) Education/Public Outreach Report [Rosendhal]
8) Mars Exploration Program [Figueroa]
9) Solar System Exploration Division [Hartman]
10) SSES Report [Drake]
11) Sun-Earth Connections Division [Fisher]
12) SECAS Report [McComas]

Other material distributed at the meeting:

1) Voyages in Education and Public Outreach—An Office of Space Science Newsletter, January 2002

[1] Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, DC 20546.